Preliminary Estimates of Protected Species Bycatch Rates in the U.S. Atlantic Pelagic Longline Fishery Between 1 April and 30 June 2006

Carol Fairfield Walsh and Lance P. Garrison
Southeast Fisheries Science Center
75 Virginia Beach Drive
Miami, FL 33027

Email: Carol.Fairfield@noaa.gov

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Background

The U.S. Atlantic Pelagic Longline fleet operates throughout the Northwestern Atlantic Ocean including along the U.S. coast from the Gulf of Mexico to New England, the waters of the Caribbean, and in international waters of the central North Atlantic Ocean. The longline fishery has a documented history of incidental takes of non-target species including billfish, marine turtles, and marine mammals. During recent years there have been elevated takes of leatherback turtles in the Gulf of Mexico (Garrison, 2003). As a result, a Biological Opinion on the pelagic longline fishery was developed by NOAA Fisheries under the Endangered Species Act, requiring several actions be taken to improve monitoring and reduce interactions with leatherback and loggerhead turtles. These regulations reopened the NED (Northeast Distant) area, with restrictions, on 30 June 2004, and similar restrictions were imposed on the rest of the fleet effective 5 August 2004. These regulations mandated that all longline gear use 16/0 or 18/0 circle hooks and eliminates J-hooks from the fishery.

The Biological Opinion requires quarterly reporting of interactions with protected species including marine mammals and marine turtles. The goal of this measure is to more closely monitor any potential short-term increases in interaction rates and thereby allow a more responsive management program. This report meets this requirement and includes the fishery effort and incidental takes observed by the pelagic longline observer program (POP) including sets from 1 April 2006 to 30 June 2006.

While it would be desirable to directly estimate the absolute level of takes (i.e. the total number of turtles estimated to be taken by the fishery), fishery effort data is reported on logbook forms by fishing captains, and current data are therefore not available until several months after the end of any given quarter. As a result, we present the bycatch rate (i.e. catch per unit effort) based solely on observer data as an indicator of the relative level of interactions with protected species. The observed bycatch rate by fishing area during quarter 2 of 2006 is compared to that observed in quarter 2 of 2005 and to the average of the previous five years (2001-2005) for quarter 2, to assess whether or not the observed rate in 2006 is unusually high or low. Bycatch rates are calculated by applying

the delta log-normal estimator using hooks as the unit of effort. The analytical methods are described in detail in Garrison (2003).

Results and Discussion

A total of 165 longline sets (116,532 hooks) were observed during quarter 2 of 2006 (Table 1). The Gulf of Mexico had by far the highest number of observed sets.

There were 10 observed interactions with leatherback turtles and 5 observed interactions with loggerhead turtles (Table 2). Seven leatherback and four loggerhead turtles were listed by the observer as released alive and injured (Appendix A). Two leatherback turtles were listed as released alive uninjured, and one additional leatherback turtle was listed as released alive and unknown whether it was injured or uninjured. The fifth loggerhead was released alive with the release condition unknown. Interactions with both species were observed in the FEC (Florida East Coast), GOM (Gulf of Mexico), and NEC (Northeast Central) areas (Table 2). The locations of observed sets and marine turtle interactions are shown in Figure 1.

One marine mammal interaction was observed with a pilot whale (Table 3). This whale was listed by the observer to be entangled, but not hooked, and released alive without serious injury. The interaction was observed in the GOM region, and this is the first observed interaction with pilot whales by the POP program in the Gulf of Mexico (Figure 2).

The quarterly and regional bycatch rates are summarized for marine turtles in Table 4 and for marine mammals in Table 5. These rates are compared with those from the same quarter/area for 2005 and the average for the second quarter/area from 2001-2005 in Tables 6 and 7. Specific information on injuries to sea turtles and gear characteristics of each interaction are shown in Appendix A.

For leatherback turtles, the bycatch rates observed in both the FEC and NEC areas for the second quarter in 2006 were elevated relative to those observed during previous years (Table 6A). There were no interactions with leatherback turtles in these areas during 2005, and the 2006 bycatch rates are near or exceed the upper bound of the 95% confidence interval for the period from 2001-2005 (Table 6A). The observed bycatch rate in the GOM is consistent with that seen in 2005, and is lower than the average for 2001-2005. The confidence limits for the 2006 estimate do not overlap with those of the 5-year average, suggesting a significant reduction in the observed bycatch rate for leatherback turtles in the GOM region.

For loggerhead turtles, no interactions were observed in the FEC, GOM, and NEC during the second quarter of 2005; however, there were observed interactions in these areas during this quarter in 2006. The 2006 bycatch rate estimate for the FEC area was elevated relative to the five year average but was within the confidence limits of the previous estimates. Likewise, the 2006 estimate for the GOM area was consistent with that observed during 2001-2005. The observed rate for the NEC area was lower than the

5 year average, and there was little overlap between the confidence limits of the 2006 estimate and the historical estimate (Table 6B).

One pilot whale was the only marine mammal observed taken during the second quarter of 2006. This is the first observation of a pilot whale interaction in the Gulf of Mexico by the POP program. The lack of observed pilot whale interactions in the MAB region during the second quarter of 2006 was unusual relative to the 2001-2005 periods and in comparison to 2005, where pilot whale interactions were reported in each of 2 observed sets.

Only circle hooks (16/0 and 18/0) were observed during the second quarter of 2006, consistent with regulations for this fishery. Concerted efforts by fishers to remove hooks and disentangle captured turtles are also mandated by the Biological Opinion. Two of the 10 leatherback turtles were entangled but not hooked on capture, and were released uninjured with no line remaining on release (Appendix A). It could not be determined if two additional leatherback turtles were hooked, but no line was remaining on release. Five of the remaining leatherback turtles were hooked in the shoulder or armpit, 4 of which were released with the hook removed and no line remaining, while the fifth leatherback was released without removing the hook and with 5 feet of line remaining. Two additional leatherback turtles appeared to be hooked, though the location was unknown. In one of these, the hook was removed and no line remained upon release. In the other, the hook was not removed and 4 feet of line remained upon release. Two of the 5 loggerheads observed caught during the second quarter of 2006 were hooked in the tongue and released with no line remaining, though one hook was not reported to have been removed upon release. Two additional loggerheads were hooked in the front flipper, and were both released with the hook removed and no line attached. It was not known if the fifth loggerhead was hooked, but it was released with no line remaining.

There are a number of caveats and uncertainties associated with the current analysis. First, while these data have gone through an initial audit and review, they are subject to change upon further review after the end of the 2006 calendar year. Second, the delta log-normal estimator was applied to calculate bycatch rates consistent with previous estimates (e.g., Garrison 2003). This approach assumes 1) that catch rates (animals per hook) are log-normally distributed, and 2) that the number of hooks is an appropriate unit of effort. The first assumption has been evaluated for turtles; however, violation of this assumption may result in biased (positive or negative) estimates of catch rate and associated variance. The second assumption has not been examined critically in previous analyses. If this assumption is not correct, for example if there are saturation effects resulting in a non-linear relationship between the number of hooks and the total catch, then there is potentially a bias in the estimate of bycatch rates.

The interaction between longline gear and marine turtles is a relatively rare event and is therefore inherently variable. Historically, there have been very large inter-annual fluctuations in bycatch rates and estimates of total bycatch. Thus, any differences observed between short term observations of bycatch rates and long term averages may

be simply stochastic events and are not necessarily indicative of a significant change in the interactions between the longline fishery and protected species.

Literature Cited

Angliss, R.P. and D.P. DeMaster. 1998. Differentiating Serious and Non-Serious Injury of Marine Mammals Taken Incidental to Commercial Fishing Operations: Report of the Serious Injury Workshop 1-2 April 1997, Silver Spring, Maryland. NOAA Technical Memorandum NMFS-OPR-13: 48 p.

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Table 1. Number of sets and hooks observed in the U.S. Atlantic Pelagic Longline Fishery between 1 April - 30 June 2006 by area.

Area	# Sets	# Hooks
CAR	-	-
FEC	12	4,523
GOM	99	75,456
MAB	3	1,735
NCA	-	-
NEC	15	12,773
SAB	36	22,045
SAR	-	-
TUN	-	-
TUS	-	-
Total	**165**	**116,532**

Table 2. Total observed interactions with marine turtles in the U.S. Atlantic Pelagic Longline Fishery for sets from 1 April - 30 June 2006 by fishing area. All turtles were recorded as being released alive. Areas with missing values indicate there was no observer coverage during this time period.

Area	Leatherback Takes Observed	Loggerhead Takes Observed
CAR	-	-
FEC	1	1
GOM	5	2
MAB	0	0
NCA	-	-
NEC	4	2
SAB	0	0
SAR	-	-
TUN	-	-
TUS	-	-
Total	**10**	**5**

Table 3. Interactions with marine mammals observed during 1 April - 30 June 2006 in the U.S. Atlantic Pelagic Longline Fishery. Observer comments and criteria described in Angliss and DeMaster (1998) were used to evaluate serious injury.

Species	Region	# Released Uninjured	# Dead	# Serious Injury
Pilot Whale	GOM	1	0	0

Table 4. Estimated bycatch rate (catch per 1000 hooks) for (A) Leatherback and (B) Loggerhead turtles by area during 1 April - 30 June 2006 in the U.S. Atlantic Pelagic Longline Fishery. Missing values indicate areas with no observer coverage. CV indicates the coefficient of variation of the estimated rate. All turtles were recorded as released alive.

A. Leatherback Turtles

Area	Observed Sets	# Positive Sets	Mean CPUE	Var CPUE	CV
CAR	0	-	-	-	-
FEC	12	1	0.2137	0.0457	1
GOM	99	4	0.0636	0.0011	0.5223
MAB	3	0	0	-	-
NCA	0	-	-	-	-
NEC	15	4	0.3438	0.0245	0.455
NED	0	-	-	-	-
SAB	36	0	0	-	-
SAR	0	-	-	-	-
TUN	0	-	-	-	-
TUS	0	-	-	-	-

B. Loggerhead Turtles

Area	Observed Sets	# Positive Sets	Mean CPUE	Var CPUE	CV
CAR	0	-	-	-	-
FEC	12	1	0.2058	0.0423	1
GOM	99	2	0.0243	0.0003	0.71
MAB	3	0	0	-	-
NCA	0	-	-	-	-
NEC	15	2	0.1502	0.0105	0.6814
NED	0	-	-	-	-
SAB	36	0	0	-	-
SAR	0	-	-	-	-
TUN	0	-	-	-	-
TUS	0	-	-	-	-

Table 5. Estimated bycatch rate (catch per 1000 hooks) for marine mammals by area during 1 April - 30 June 2006 in the U.S. Atlantic Pelagic Longline Fishery. CV indicates the coefficient of variation of the estimated rate.

Species	Serious Injury	Area	# Positive Sets	#Observed Sets	Mean CPUE	Var CPUE	CV
Pilot Whale	N	GOM	1	99	0.0104	0.0001	1.0000

Table 6. Bycatch rates for (A) Leatherback turtles and (B) Loggerhead turtles in the U.S. Atlantic Pelagic Longline Fishery during 1 April - 30 June 2006 and comparison to rates from the previous year (2005) and the average for this quarter from the previous five years (2001-2005). 95% CI indicates the estimated 95% confidence interval of the mean bycatch rate (CPUE) in each cell assuming a lognormal distribution of rates. Missing values indicate areas with no observer coverage.

A. Leatherback Turtles

Area	2006 CPUE	2006 95% CI	2005 CPUE	2005 95% CI	2001-2005 CPUE	2001-2005 95% CI
CAR	-	-	-	-	0.0598	0.0122 - 0.2924
FEC	0.2137	0.0437 – 1.0445	0	-	0.0923	0.0256 - 0.3330
GOM	0.0636	0.0249 – 0.1621	0.0524	0.0210 – 0.1307	0.2133	0.1624 - 0.2801
MAB	0	-	0	-	0.2675	0.1413 - 0.5065
NCA	-	-	0	-	0.0209	0.0043 - 0.1021
NEC	0.3438	0.1504 – 0.7859	0	-	0.0956	0.029 - 0.3155
NED	-	-	-	-	-	-
SAB	0	-	0	-	0.0483	0.0230 - 0.1016
SAR	-	-	-	-	-	-
TUN	-	-	-	-	-	-
TUS	-	-	-	-	-	-

B. Loggerhead Turtles

Area	2006 CPUE	2006 95% CI	2005 CPUE	2005 95% CI	2001-2005 CPUE	2001-2005 95% CI
CAR	-	-	-	-	0.0575	0.0118 - 0.2809
FEC	0.2058	0.0421 – 1.0058	0	-	0.1098	0.0284 - 0.4250
GOM	0.0243	0.0072 – 0.0822	0	-	0.0275	0.0137 - 0.0552
MAB	0	-	0	-	-	-
NCA	-	-	0.0842	0.0172 – 0.4115	0.1835	0.0912 - 0.3692
NEC	0.1502	0.0463 – 0.4873	0	-	0.8389	0.4264 - 1.6504
NED	-	-	-	-	-	-
SAB	0	-	0	-	0.0389	0.0159 - 0.0953
SAR	-	-	-	-	-	-
TUN	-	-	-	-	-	-
TUS	-	-	-	-	-	-

Table 7. Summary of bycatch rates for marine mammals in the U.S. Atlantic Pelagic Longline Fishery during 1 April - 30 June 2006 and comparison to rates from the previous year (2005) and the average for this quarter from the previous five years (2001-2005). 95% CI indicates the estimated 95% confidence interval of the mean bycatch (CPUE) in each cell assuming a lognormal distribution of rates. CPUEs reflect total marine mammals caught including alive, dead, and seriously injured animals.

Species	Area	2006 CPUE	2006 95% CI	2005 CPUE	2005 95% CI	2001-2005 CPUE	2001-2005 95% CI
Atlantic Spotted Dolphin	MAB	0	0	0	-	0.0265	0.0054 – 0.1293
Bottlenose Dolphin	NCA	0	0	0	-	0.0209	0.0043 – 0.1021
Risso's Dolphin	NEC	0	0	0	-	0.0801	0.0164 – 0.3917
Minke Whale	NEC	0	0	0	-	0.0509	0.0104 – 0.2487
Pilot Whale	MAB	0	-	1.3369	1.3369 – 1.3369	0.1803	0.0908 – 0.3583
Pilot Whale	GOM	0.0104	0.0021 – 0.0510	0	-	0	-

Figure 1. Observed U.S. Atlantic Pelagic Longline Fishery effort and marine turtle interactions during 1 April - 30 June 2006. The pelagic longline fishing areas in the North Atlantic Ocean are as follows: CAR = Caribbean, GOM = Gulf of Mexico, FEC = Florida East Coast, SAB = South Atlantic Bight, SAR = Sargasso Sea, MAB = Mid-Atlantic bight, NEC = Northeast Coastal, NED = Northeast Distant, NCA = North Central Atlantic, TUN = Tuna North. Seasonal closed areas for the fishery are indicated by gray hatched areas.

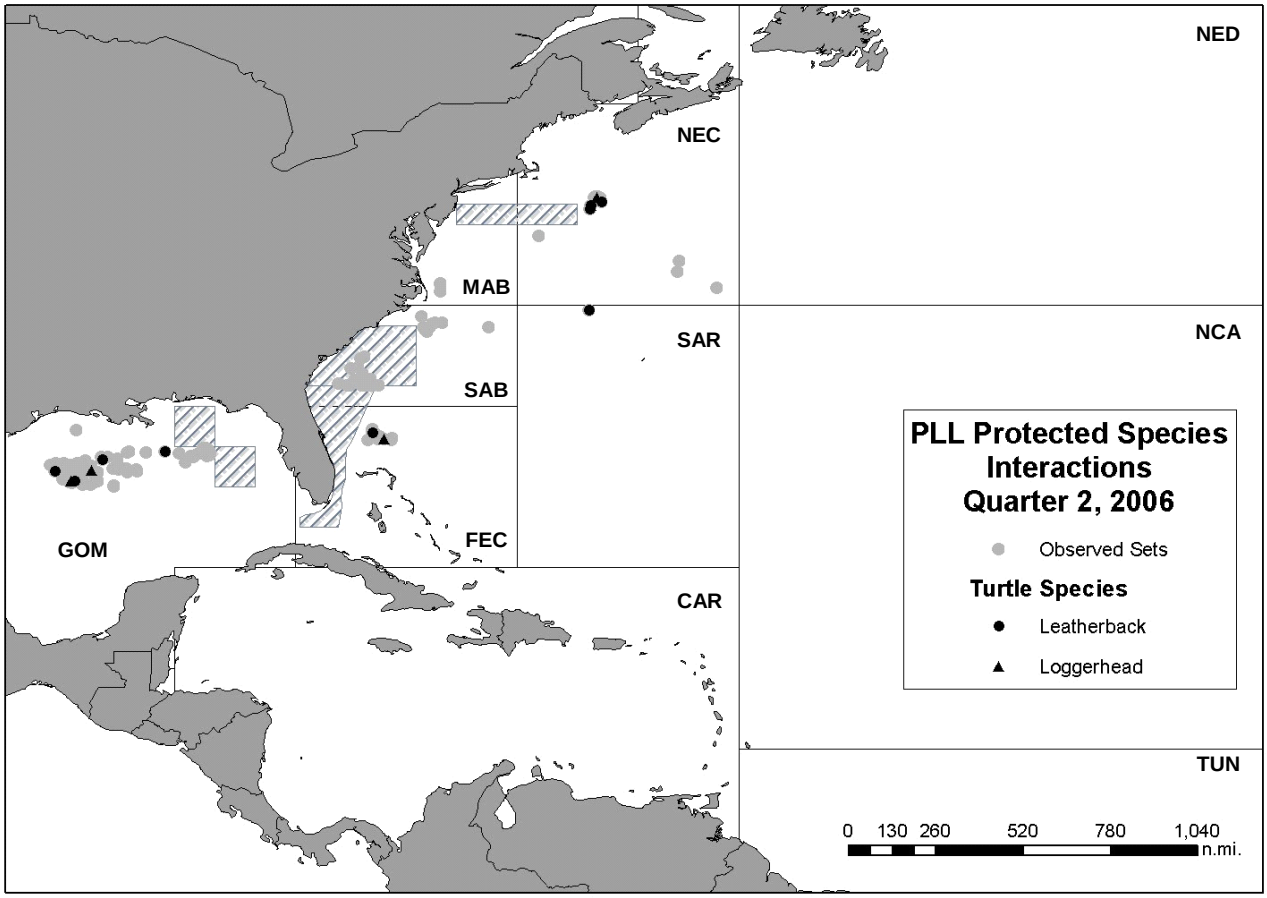
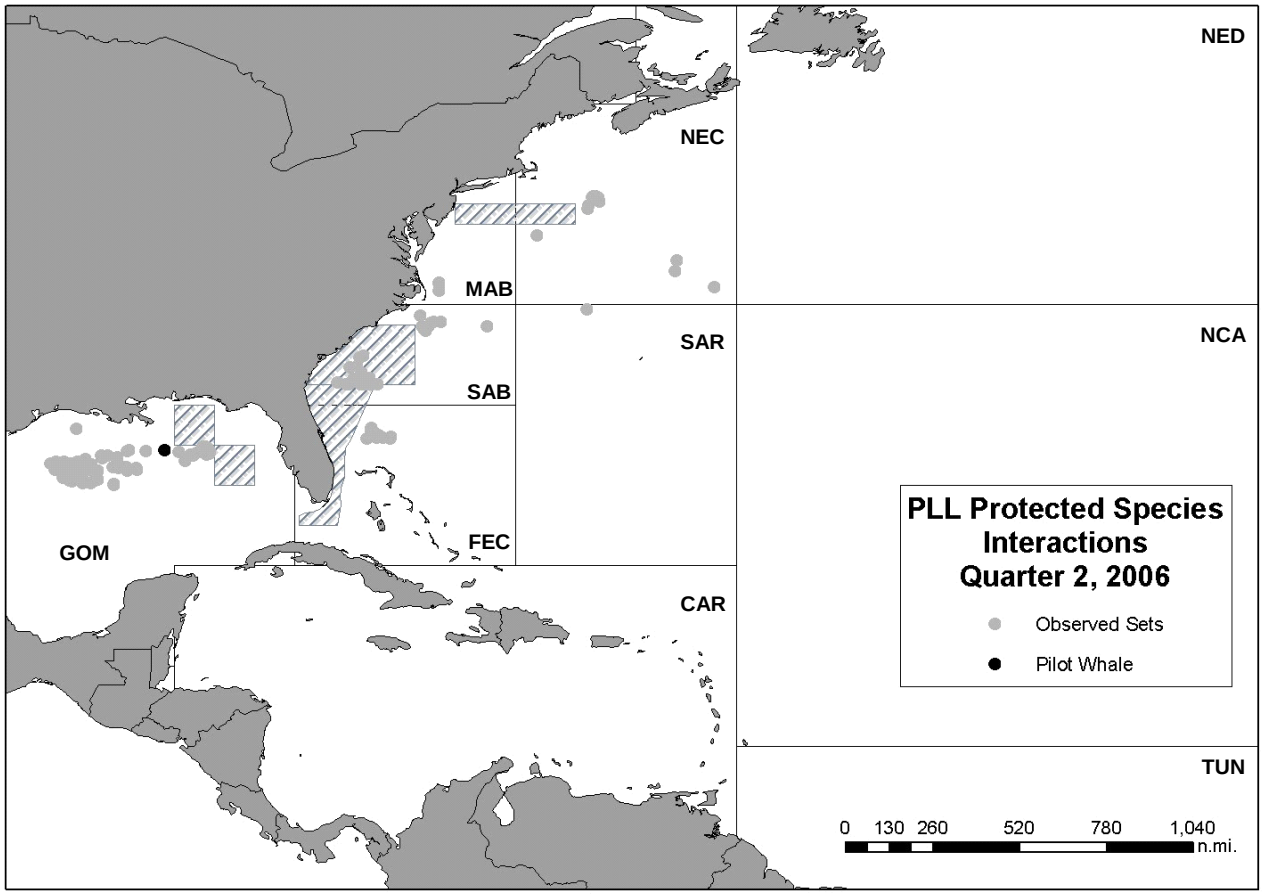


Figure 2. Observed U.S. Atlantic Pelagic Longline Fishery effort and marine mammal interactions during 1 April - 30 June 2006. The pelagic longline fishing areas in the North Atlantic Ocean are as follows: CAR = Caribbean, GOM = Gulf of Mexico, FEC = Florida East Coast, SAB = South Atlantic Bight, SAR = Sargasso Sea, MAB = Mid-Atlantic bight, NEC = Northeast Coastal, NED = Northeast Distant, NCA = North Central Atlantic, TUN = Tuna North. Seasonal closed areas for the fishery are indicated by gray hatched areas. The NED area was reopened on June 30, 2004.



Appendix A: Injury details and hook types for marine turtles captured in the U.S. Atlantic Pelagic Longline Fishery for sets during 1 April - 30 June 2006.

A. Leatherback Turtles

Obs.#	Area	Hook Type	Offset (degrees)	Bait	Bait Size (g)	Release Condition	Hook Location	Jaw Location	Hook Visible?	Hook Removed?	Entangled Capture?	Entangled Release?	Line Left (ft)	CL Est. (ft)	CCL (cm)	Straight N-N (cm)
1	FEC	C-18/0	10	squid or mackerel	300 or 500	Alive, injured	unknown location			yes	no	no	0.00	4.00		
2	GOM	C-16/0	0	squid	196	Alive, injured	unknown location			no	unknown	unknown	4.00	3.00		
3	GOM	C-16/0	0	squid	196	Alive, injured	shoulder	na	na	no	yes	yes	5.00	3.00		
4	GOM	C-16/0	0	squid	300	Alive, injured	shoulder	na	na	yes	no	no	0.00	5.00		
5	GOM	C-16/0	0	squid	200	Alive, injured	shoulder	na	na	yes	no	no	0.00	4.50		
6	GOM	C-16/0	0	squid	275	Alive, injured	shoulder	na	na	yes	no	no	0.00	5.00		
7	NEC	C-18/0	10	squid or mackerel	213 or 314	Alive, uninjured	not hooked	na	na	na	yes	no	0.00	4.00		
8	NEC	C-18/0	10	squid	213 or 314	Alive, injured	armpit	na	na	yes	yes	no	0.00		150.2	
9	NEC	C-18/0	10	squid or mackerel	213 or 155	Alive, unknown	not known if hooked			yes	unknown	no	0.00	6.00		
10	NEC	C-18/0	10	squid or mackerel	214 or 315	Alive, uninjured	not hooked	na	na	na	yes	no	0.00		139.5	

Appendix A (cont.): Injury details and hook types for marine turtles captured in the U.S. Atlantic Pelagic Longline Fishery for sets during 1 April - 30 June 2006.

B. Loggerhead Turtles

Obs.#	Area	Hook Type	Offset (degrees)	Bait	Bait Size (g)	Release Condition	Hook Location	Jaw Location	Hook Visible?	Hook Removed?	Entangled Capture?	Entangled Release?	Line Left (ft)	CL Est. (ft)	CCL (cm)	Straight N-N (cm)
1	FEC	C-18/0	10	squid or mackerel	232 or 333	Alive, injured	tongue	na	na	no	no	no	0.00	2.50		
2	GOM	C-16/0	0	squid	186	Alive, injured	front flipper	na	na	yes	no	no	0.00	2.50		
3	NEC	C-18/0	10	squid or mackerel	213 or 314	Alive, injured	front flipper	na	na	yes	no	no	0.00		76.7	69.5
4	NEC	C-18/0	10	squid or mackerel	213 or 155	Alive, injured	tongue	na	na	yes	no	no	0.00		70.1	63.6
5	GOM	C-16/0	0	squid	112.5	Alive, unknown	not known if hooked			yes	no	no	0.00			